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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Means for operating the Stoppers of Casting Ladles

We, JUNKERATHER MASCHINENFABRIK G.M.B.H. Jünkerath-Eifel, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The invention relates to casting ladles in which the teeming nozzle fitted in the bottom of the ladle can be closed by a stopper carried by a stopper rod.

The stopper rod in casting ladles is rigidly secured, through a transverse connection such as a crossbar above the rim of the ladle, to a guide rod, which is carried so as to slide axially in relation to the side of the ladle and which generally has axial motion imparted to it by a hand lever, for the purpose of opening and closing the nozzle when given portions of the ladle contents are to be teemed. The constantly repeated use of the hand lever involves the expenditure of considerable energy, especially now that it has become usual to employ large-capacity ladles, with their correspondingly heavier stoppers and guide rods.

In order to avoid this expenditure of physical energy and to eliminate the continual use of the cumbersome hand lever, it has been proposed that the guide rod should be worked by means of a pressure-operated plunger in a cylinder, oil being used as the pressure medium, since gases such as compressed air are too voilent in their action and the heat radiated against the cylinder by the ladle would cause pressure fluctuations. As with manual operation, it must still be possible, when using a pressure cylinder, to stop the guide rod in any position. One of the existing special locking devices used for manual working can be employed for this purpose. This locking is essential, if the position of the stopper is not to be subject to involutary changes due for example to leakage losses of the pressure oil. Auxiliary hand gear, such as a hand pump fitted near the cylinder and acting on the plunger, is provided for special emergencies, such as possible failure of the pump drive or of the pump itself.

These systems, which involve the use of a motor, a pump, and a pressure feed system with fittings, have not proved wholly satisfactory. The time-consuming operation of the guide rod locking device, necessary since the pressure thrust mechanism is not self-locking, is a disadvantage. Moreover, the auxiliary gear is dependent on a supply of the pressure medium, so that this stand-by equipment cannot be brought into play if the pressure-medium feed system should break down.

The purpose of the invention is to provide a more satisfactory mechanism.

The invention provides a ladle stopper rod operating device comprising a self-locking, electrically driven lifting and lowering mechanism, fitted to and guided by a mounting adapted to be fixed to the outside of the ladle. The term 'self-locking' is to be understood herein as designating drive mechanisms in which the input and output are not interchangeable in function, and which will therefore not run under forces imposed by the stopper rod and its associated movable apparatus.

In particular embodiments the mechanism comprises a threaded spindle and nut drive or a worm and rack drive, for example with the spindle or the rack as the case may be rigidly connected to the stopper rod.

The lifting and lowering mechanism being self-locking, there is no need for the time-consuming manual locking of the guide rod, and the separate locking device can be dispensed with. Hence only one operator is needed. By means of switch-gear suspended from the foundry crane, the operator can control the traversing and hoisting equipment of the crane, while also controlling the stop-

per rod by the use of a switch which operates the lifting and lowering mechanism. In addition to this, it now becomes a simple matter to provide a self-locking auxiliary manual drive. This is operated, in the event of a current failure, faults in the motor and so on, to impart axial motion to the stopper rod. The hand equipment, while being simple in design, is self-locking by virtue of the fact that, for example, a hand crank is geared to the shift nut of the lifting and lowering mechanism and thus imparts axial motion to the spindle. Where the lifting and lowering mechanism consists of a gear train, in which, for example, a worm driven by an electric motor imparts axial motion to a suitably toothed rack, the hand crank acts on the worm.

A further advantage is the absence of oil feed pipes, pump and fittings. The casing of the lifting and lowering mechanism is fitted with a plug, so that the current supply lead can be connected quickly and easily at any time, whereas the connection of oil pipes to hydraulic equipment is troublesome and liable to faults.

If the usual guide rod be retained, it is certainly possible to dispose that part of the mechanism which carries out the rising and falling motion within or practically within the ideal longitudinal axis of the guide rod and to connect it to this with sufficient freedom of movement to enable any differences in the direction and position of the axes to be compensated. This arrangement of the operating mechanism is more complicated, however, and occupies more space. Moreover, the bearing positions of the guide rod then lie very close together, so that the turning and tipping moments that arise are not as well absorbed. With the lifting and lowering mechanism disposed as now proposed, not only can the stopper guide rod and articulated coupling be dispensed with, but a compact construction reduced to about one-half the length is achieved. This is a great advantage in general, and especially with ladle cars, irrespective of whether the part that carries out the rising and falling motion is the spindle (or toothed rack)—that is to say the non-rotating part—or the shift nut (or worm) carried inside the housing—that is to say the rotating part.

In one particularly advantageous form of construction, the shift nut (or the worm) carries out the rising and falling motion, being enclosed in a housing which is free to slide in a casing that is rigidly mounted on the outside of the ladle. The lower end of the spindle (or rack) here rests in a supporting bearing in or below the bottom of the casing. In order to avoid frictional obstruction, this bearing is in the form of a joint, consisting of a pin whch can move horizontally in a short slot. Thus the casing can completely enclose the operating mechanism and effectively shield it from splashes of metal and other sources of damage. The casing is fitted with slides for the lifting unit, these being of such a nature—they may consist, for example, of slide surfaces which form an angle with each other—that the turning moments applied by the stopper rod when the ladle is tipped, as well as the radial stresses, are absorbed. The casing carries a slot for the connection of the electric power lead and for the manual drive. With the operating mechanism constructed as described, in which the spindle does not move, the manual drive is favourably situated, being near to the upper rim of the ladle, where it does not constitute an obstruction, besides being easy to reach from the ladle car.

At the top, the operating mechanism terminates in a thrust rod, which transmits its motion to the cross-bar. The thrust rod may be a separate member flanged to the housing of the shift mechanism.

The shift nut is actuated by a motor located inside the housing. The nut may suitably be coaxial with the rotor and bear against axial bearings.

One form of construction of the means according to the invention is diagrammatically illustrated by way of example in the accompanying drawings, in which

Figure 1 shows operating means, in part section, with stationary spindle, the housing carrying out the rising and falling movement, and

Figure 2 is a cross-section of the means, through the line I—I in Figure 1.

In the bottom of the casting ladle 1 is a teeming nozzle, 2, which is opened and closed by the stopper rod 3. The stopper rod 3 is moved by an electrically operated self-locking lifting and lowering mechanism 5, carried on the side of the ladle and sliding axially, its motion being conveyed through the cross-bar 4. The mechanism 5 consists essentially of a spindle 6, or a toothed rack, on which the housing 5*a* of the mechanism 5 can be axially displaced by means of a shift nut 8, which bears against the thrust bearing 7, or by a worm engaging with the rack. The spindle 6 or the rack rests on a supporting bearing 9. The shift nut 8 is driven by an electric motor 10, and is disposed coaxially with the rotor thereof 10*a*. Thus in the form of construction illustrated by way of example, it constitutes the core of the rotor 10*a* and when rotated carries out a rising and falling motion, which is transmitted by the thrust bearings 7 to the housing 5*a* of the mechanism 5. On the housing 5*a* a flange secures a thrust rod 11, which slides axially in a bush 12, and the motion of which is conveyed to the cross-bar 4. The bush 12 is fitted into the top end of a casing 13, which is rigidly secured to the side of the ladle 1, and completely encloses the operating mecha-

nism 5 and carries the bearing 9 at its lower end. The bearing 9 consists of a pin, which can move horizontally with respect to a slot 14, so that the spindle 6 may accomodate itself to avoid undue frictional forces.

To enable the mechanism 5 to be fitted into the casing 13, the casing has a removable base 15. The casing 13 also has slide rails 16, which form an axial guide for the housing 5*a*, the housing 5*a* being fitted with slides 17. The slide surfaces of the guide are at an angle to each other, so as to absorb any turning and tipping moments produced by the stopper rod 3 when the ladle is tipped.

In addition, the casing 13 has a slot 18, for a cable connection (not shown), and for the hand operating gear 19. The auxiliary hand operating gear is also self-locking, since it acts through gears which can be engaged and disengaged, on the self-locking shifting mechanism.

For pouring from the ladle when a crane is used, the hand drive 19 is fitted lower down than shown in the drawing, so that it may be within easier reach of the operator.

WHAT WE CLAIM IS:—

1. Operating means for the stopper rod of a casting ladle, comprising a self-locking lifting and lowering mechanism driven by an electric motor and fitted to and guided by a mounting adapted to be fixed to the outside of a ladle.

2. Operating means according to claim 1, in which the lifting and lowering mechanism comprises a threaded spindle and shift nut, or a worm and rack.

3. Operating means according to claim 2, in which the spindle is rigidly connected to the stopper rod and can be axially displaced by the shift nut, the shift nut being actuated by the electric motor.

4. Operating means according to claim 2, in which the rack is rigidly connected to the stopper rod and can be displaced longitudinally by means of the worm, the worm being actuated by the electric motor.

5. Operating means according to claim 2, in which the threaded spindle or the rack rests on the supporting bearing, and the nut or the worm as the case may be carries out the lifting and lowering movement, being mounted for rotation by means of the electric motor ing a bearing rigidly connected to the stopper rod.

6. Operating means according to claim 5, in which the spindle or the rack is capable of a limited movement, in the supporting bearing, in the plane containing the axes of the stopper rod and the spindle or rack.

7. Operating means according to any one of claims 1 to 6, provided with a self-locking manually operated auxiliary drive.

8. Operating means according to claim 7 as appendant to any one of claims 2 to 6, in which the manual drive operates the shift nut or the worm as the case may be.

9. Operating means according to any one of claims 1 to 8, in which guides are provided for the member which carries out the lifting and lowering movement, the guides being so constructed that the turning moments applied by the stopper rod when the ladle is tipped, as well as radial stresses, are absorbed.

10. Operating means according to any of claims 1 to 9, in which a casing encloses the mechanism and has a slot to allow for the connection of an electric power lead and a manually operated drive.

11. Operating means, substantially as hereinbefore described and illustrated in the accompanying drawings.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

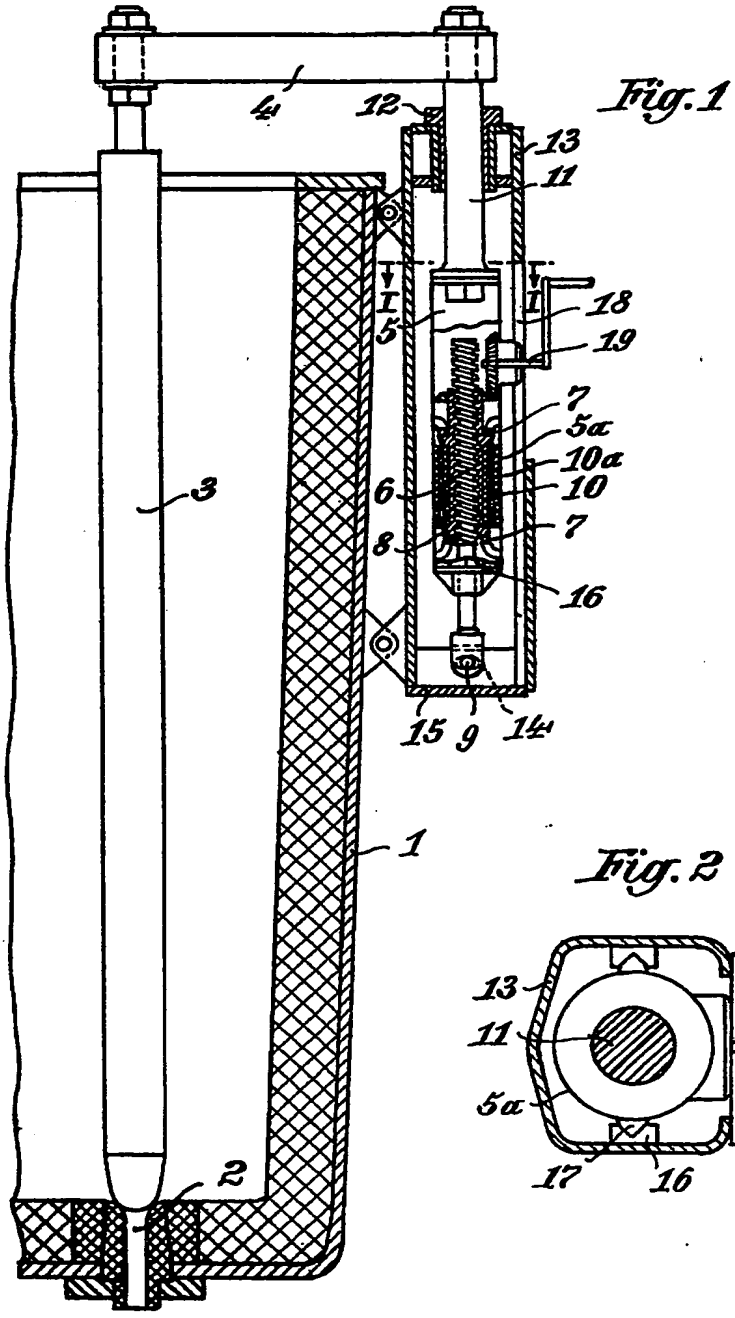

Fig. 1

Fig. 2